

# Selection and parallel trends\*

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## Abstract

We study the connection between selection into treatment and the parallel trends assumptions underlying difference-in-differences (DiD) designs. We start by deriving necessary and sufficient conditions for the (unconditional) parallel trends assumption. These conditions demonstrate that parallel trends cannot hold absent restrictions on the selection mechanism and/or the distribution of (time-varying) unobservable determinants of the outcome. We then consider different restrictions on the selection mechanism and provide a menu of interpretable primitive sufficient conditions, which constitute a formal framework for justifying DiD in practice. We derive results for both separable and nonseparable outcome models and show that this distinction has implications for the role of covariates in making parallel trends assumptions more plausible. Building on our analysis of nonseparable models, we connect DiD to the literature on nonparametric identification in panel models.

**Keywords:** causal inference, conditional parallel trends, covariates, difference-in-differences, selection mechanism, time-invariant and time-varying unobservables, treatment effects

**JEL Codes:** C21, C23

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